

CLAIMS

What is claimed is:

1. An apparatus for manufacturing unitary concrete blocks, comprising:
 - a form defining a desired shape that holds a volume of composite;
 - a form loading station that receives composite and delivers the composite to the form;
 - a station conveyor that conveys the form about the apparatus in a continuous loop;
 - a curing oven, wherein the station conveyor conveys the composite-filled form from the form loading station through the curing oven, thereby curing the composite into a unitary concrete block; and
 - a block removal station that, upon delivery of the form from the curing oven via the stationer conveyor, removes the unitary concrete block from the form.
2. The apparatus according to claim 1, wherein the form comprises:
 - a bottom assembly, whereby the bottom assembly couples with the station conveyor for conveyance;
 - a wall assembly that seats on the bottom assembly; and
 - a cap that seats on the wall assembly.
3. The apparatus according to claim 2, wherein the wall assembly comprises:
 - walls; and
 - mating assemblies that couple the walls, thereby forming the desired shape that is assembled and disassembled.

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4. The apparatus according to claim 3, wherein the walls comprise:
 - two sidewalls located opposite and parallel to each other; and
 - two endwalls located opposite and parallel to each other.
 5. The apparatus according to claim 3, further comprising interior walls that divide the form into sections.
 6. The apparatus according to claim 3, further comprising hinges that couple the walls, whereby the walls assemble and disassemble.
 7. The apparatus according to claim 3, wherein each mating assembly comprises:
 - fixed brackets that attach to a respective wall;
 - sliding brackets that attach to a corresponding wall and define slots that hingedly attach to a corresponding fixed bracket;
 - a fixed rod with a hook extending perpendicular from the fixed rod, wherein top and bottom ends of the fixed rod link the fixed brackets;
 - a sliding rod with a stud and a tab both extending perpendicular from the sliding rod, wherein top and bottom ends of the sliding rod hingedly link the sliding brackets through each slot, whereby the sliding rod slides back and forth to assemble and disassemble the wall assembly; and
 - an engaging rod hingedly connected to the tab of the sliding rod and extending outwardly from the tab.
 8. The apparatus according to claim 3, wherein each mating assembly comprises:
 - a first bracket attached to a respective wall;
 - a second bracket attached to the same wall as the first bracket;
 - a third bracket attached to an adjacent wall;

a pivot rod pivotally attached to the first bracket;
a lever pivotally attached to the second bracket;
a first rod fixedly attached to the third bracket and hingedly attached to the lever;
a second rod fixedly attached to the pivot rod and hingedly attached to the lever;
a lever arm fixedly attached to the pivot rod, whereby pivoting the lever arm assembles and disassembles the wall assembly.

9. The apparatus according to claim 2, further comprising a latch assembly that couples the bottom assembly, the wall assembly, and the cap.
10. The apparatus according to claim 9, wherein the latch assembly comprises:
 - a latch that pivotally attaches to the walls, whereby the latch is adapted to rotate from an engagement position to a release position; and
 - a latch spring connecting the latch to a respective wall imparting a rotational force on the latch, thereby rotating the latch to the engagement position.
11. The apparatus according to claim 10, further comprising a locking rod that pivotally connects to the latch, whereby sliding the locking rod back and forth rotates the corresponding latch.
12. The apparatus according to claim 11, further comprising a locking rod clip that attaches to the wall, whereby the locking rod clip limits the locking rod to one-dimensional motion.
13. The apparatus according to claim 2, further comprising lifting dowels that allow the form to be lifted.
14. The apparatus according to claim 2, wherein the cap comprises a plate with shapes extending perpendicular from the plate defining hollow areas within the unitary concrete block.
15. The apparatus according to claim 14, wherein a base of the shapes slope into a cone shape to allow for easier removal of the cap.

16. The apparatus according to claim 2, wherein the cap further comprises cap brackets attached to the cap, whereby the cap brackets are adapted for engagement that removes and replaces the cap.

17. The apparatus according to claim 2, wherein the bottom assembly comprises a base with shapes extending perpendicular from the plate defining hollow areas within the unitary concrete block.

18. The apparatus according to claim 2, wherein the bottom assembly includes wheels attached to the bottom of the base, whereby the form engages the station conveyor.

19. The apparatus according to claim 1, wherein the form loading station comprises:

a cap removal/replacement assembly that removes and replaces the cap on the form;

a screed assembly that receives composite and delivers the composite into the form;

a compression assembly that compresses the composite-filled form, thereby sealing the composite therein.

20. The apparatus according to claim 19, wherein the cap removal/replacement assembly comprises:

a cap arm;

a cap cylinder attached to the cap arm, wherein the cap cylinder rotates the cap arm from an engagement position to a retracted position; and

a catch assembly hingedly attached to the cap arm, whereby the catch assembly rotates between an lifting position and a bypass position.

21. The apparatus according to claim 20, wherein the catch assembly comprises:

a catch hingedly attached to the cap arm; and

a catch spring that pulls the catch to the engagement position.

22. The apparatus according to claim 20, wherein in the engagement position the cap arm engages the cap.
23. The apparatus according to claim 20, wherein in the retracted position the cap arm rotates to allow the screed assembly to pass below the cap arm with the removed cap.
24. The apparatus according to claim 20, wherein in the lifting position the catch supports the cap engaged by the cap arm.
25. The apparatus according to claim 20, wherein in the bypass position the catch rotates until the catch allows the cap to bypass the catch assembly as the station conveyor moves the form forward.
26. The apparatus according to claim 19, wherein the screed assembly comprises:
- a screed track extending over the station conveyer;
 - a screed box coupled with the screed track;
 - a screed cylinder coupled with the screed box, whereby the screed cylinder conveys the screed box along the screed track between a retracted position and a loading position;
 - a leveling hopper disposed within the screed box that fills and levels the form with composite; and
- a leveling cylinder coupled with the leveling hopper, whereby the leveling cylinder slides the leveling hopper back and forth inside the screed box.
27. The apparatus according to claim 26, wherein the screed assembly further comprises:
- an auger disposed within the leveling hopper that evenly distributes composite into the form;
 - and
 - a screed motor coupled with the auger, whereby the screed motor rotates the auger.

28. The apparatus according to claim 26, wherein in the retracted position the screed box allows the cap removal/replacement assembly and compression assembly to engage the form.
29. The apparatus according to claim 26, wherein in the loading position the screed box is directly over the form.
30. The apparatus according to claim 19, wherein the compression assembly comprises:
- an extension arm;
 - a compression motor that rotates the extension arm between a bypass position and an engagement position;
 - a compression arm hingedly attached to the extension arm; and
 - a compression cylinder that couples to the compression arm, whereby the compression cylinder rotates the compression arm between a compression position and a released position.
31. The apparatus according to claim 30, wherein the compression assembly further comprises a stabilizer hingedly attached to the compression arm, whereby the stabilizer swivels to produce level contact with the form when the compression arm is rotated to the compression position.
32. The apparatus according to claim 30, wherein in the engagement position the extension arm causes the compression arm to engage the form.
33. The apparatus according to claim 30, wherein in the bypass position the extension arm allows the station conveyor to move the form forward bypassing the compression assembly.
34. The apparatus according to claim 30, wherein in the compression position the compression arm depresses the form until the wall assembly is completely seated on the bottom tube assembly and the cap is completely seated on the wall assembly.
35. The apparatus according to claim 30, wherein in the released position the compression arm disengages the form.

36. The apparatus according to claim 1, wherein the station conveyor comprises:
- a track assembly that conveys the form along straight sections;
 - a turnstile that conveys the form along curved sections; and
 - a guide rail along straight and curved sections that provides a fixed pathway for the conveyance of the form.
37. The apparatus according to claim 36, wherein the track assembly comprises:
- a conveyor rod extending the entire length the straight section;
 - a conveyor cylinder coupled with the conveyor rod, whereby the conveyor cylinder extends and retracts the conveyor rod; and
- a catch assembly attached at appropriate intervals along the conveyor rod, whereby the catch assembly rotates between an engagement position and a bypass position.
38. The apparatus according to claim 37, further comprising bearings that rigidly attach to the guide rail at appropriate intervals along the conveyor rod, whereby the bearings restrict the conveyor rod to one-dimensional motion parallel with the conveyor cylinder.
39. The apparatus according to claim 37, further comprising roller pins that attach to the guide rail at appropriate intervals, whereby the roller pins provide support without restricting motion to the conveyor rod.
40. The apparatus according to claim 37, wherein the catch assembly comprises:
- a catch hingedly attached to the conveyor rod;
 - a catch stop that rigidly attaches to the conveyor rod directly preceding each catch; and
 - a catch spring that pulls the catch until it abuts the catch stop.
41. The apparatus according to claim 37, wherein in the engagement position the catch spring pulls the conveyor catch until the conveyor catch abuts the catch stop, whereby the catch

assembly engages the form as the conveyor cylinder coupled with the conveyor rod advances in the direction of forward motion of the station conveyor.

42. The apparatus according to claim 36, wherein in the bypass position the conveyor catch rotates until the catch allows the form to bypass the catch assembly as the conveyor cylinder coupled with the conveyor rod moves in the direction opposite of forward motion of the station conveyor.

43. The apparatus according to claim 1, wherein the station conveyor conveys one or more forms simultaneously to accommodate various production rates.

44. The apparatus according to claim 1, wherein block removal station comprises:

a lock assembly that locks the bottom assembly of the form in place;
a bottom release assembly that uncouples the bottom assembly, walls, and cap;
a lift assembly that raises and lowers the wall assembly and cap of the form between levels;
a wall release and engagement assembly that disassembles and reassembles the walls,
whereby the walls disassemble releasing the unitary concrete block from the form and the walls
reassemble for reuse of the form; and
a swing-arm assembly that removes the unitary concrete block from the block removal
station.

45. The apparatus according to claim 44, wherein the block removal station further comprises a dispatch conveyor that receives the unitary concrete block from the swing-arm assembly and conveys the unitary concrete block from the apparatus to a desired storage, shipping, or packaging area.

46. The apparatus according to claim 44, wherein the lock assembly comprises:
- lock cylinders; and
 - lock fingers hingedly attached to the lock cylinders, whereby the lock cylinders rotate the lock fingers between a locked position and an unlocked position.
47. The apparatus according to claim 44, wherein the bottom release assembly comprises:
- a release cylinder; and
 - a release clip attached to the release cylinders, whereby the cylinder extends and retracts the release clip between an engagement position and a retracted position.
48. The apparatus according to claim 44, wherein lift assembly comprises:
- a frame;
 - a slide coupled with the frame that travels along the frame, wherein the slide engages the wall assembly and cap;
 - a first pulley attached to the frame;
 - a second pulley;
 - a chain connecting from the slide to the frame wherein the chain runs along the first and second pulleys; and
 - a lift cylinder attached to the second pulley, whereby the cylinder extends and retracts the second pulley to convey the slide between a lower level and an upper level.
49. The apparatus according to claim 44, wherein wall release and engagement assembly comprises:
- a release clip that engages the mating assembly coupling the walls;
 - a release cylinder attached to the release clip, whereby the release cylinder extends and retracts to disassemble the walls;

an engagement clip that engages the mating assembly coupling the walls; and
an engagement cylinder attached to the engagement clip, whereby the engagement cylinder extends and retracts to assemble the walls.

50. The apparatus according to claim 44, wherein the swing-arm assembly comprises:

- a swing-arm member;
- a first gear pivotally attached to the swing-arm member;
- a loading arm pivotally attached to the first gear, whereby the loading arm supports the unitary concrete block; and
- a first rotary motor coupled with the swing-arm member, whereby the first rotary motor rotates the swing-arm member between a loading position and an unloading position;
- an unloading post;
- a second gear that engages the first gear when the swing-arm member is in the unloading position; and
- a second rotary motor attached to the unloading post and coupled with the second gear, whereby the second rotary motor rotates the loading arm, between an upright position and a dispatch position via the second gear which is engaged with the first gear.

51. The apparatus according to claim 50, wherein the loading position comprises a position, whereby the loading arm is extended directly over the station conveyor.

52. The apparatus according to claim 50, wherein in the unloading position the loading arm is extended directly over the dispatch conveyor.

53. The apparatus according to claim 50, wherein in the upright position the loading arm supports the unitary concrete block.

54. The apparatus according to claim 50, wherein in the dispatch position the loading arm delivers the unitary concrete block.

55. The apparatus according to claim 1, further comprising a grinder that reduces the size of polystyrene pieces.

56. The apparatus according to claim 55, wherein the grinder comprises:

a coarse grinder that reduces polystyrene into small pieces; and

a fine grinder that receives small pieces of polystyrene from the coarse grinder and reduces the small pieces into even smaller particles.

57. The apparatus according to claim 56, further comprising a sieve that allows only a desired size of smaller particle to be delivered from the grinder.

58. The apparatus according to claim 1, further comprising an ingredient metering assembly that receives desired ingredients, whereby the ingredient metering assembly meters and delivers appropriate amounts of desired ingredients to produce a composite.

59. The apparatus according to claim 58, wherein the ingredient metering assembly comprises:

a hopper that receives and delivers desired ingredients;

a scale attached to the hopper that measures an amount of desired ingredients contained in the hopper; and

a computer in communication with the scale and hopper that controls the type and quantity of desired ingredients the hopper receives and delivers.

60. The apparatus according to claim 59, further comprising an auger to convey desired ingredients into the hopper.

61. The apparatus according to claim 59, further comprising a pump to convey desired ingredients into the hopper.

62. The apparatus according to claim 58, further comprising a heater to heat the desired ingredients.
63. The apparatus according to claim 58, wherein the desired ingredients comprise:
- water;
 - cement; and
 - polystyrene.
64. The apparatus according to claim 63, wherein the desired ingredients further comprise a superplasticizer that increases the flowability, delays curing time, and increase the ultimate compressive strength of the resulting composite.
65. The apparatus according to claim 63, wherein the desired ingredients further comprise a water conditioner that increases the hydration hardness of the resulting composite.
66. The apparatus according to claim 63, wherein the desired ingredients further comprise an accelerant that decreases the curing time of the resulting composite.
67. The apparatus according to claim 63, wherein the water is heated to a temperature of at least 150° F.
68. The apparatus according to claim 1, further comprising a mixer that receives the ingredients from the ingredient metering assembly, whereby the mixer combines the ingredients producing a composite.
69. The apparatus according to claim 68, wherein the mixer further comprises a mixer discharge hopper that stores composite until needed by the form loading station.

70. A method for manufacturing unitary concrete blocks, comprising:
- mixing desired ingredients into a composite;
 - loading the composite into a form of a desired shape;
 - curing the composite into a unitary concrete block; and
 - removing the unitary concrete block from the form.
71. The method according to claim 70, further comprising grinding polystyrene into small particles.
72. The method according to claim 70, further comprising metering predetermined amounts of desired ingredients.
73. The method according to claim 72, wherein metering predetermined amounts of desired ingredients comprises:
- conveying the desired ingredient into a hopper;
 - measuring an amount of the desired ingredient; and
 - delivering the desired ingredient to a mixer.
74. The method according to claim 70, wherein loading the composite into a form of desired shape comprises:
- removing a cap from the form;
 - delivering the composite into the form;
 - replacing the cap onto the form; and
 - compressing the form, whereby the composite is sealed therein.

75. The method according to claim 73, wherein delivering the composite into the form comprises:

conveying a screed box to a loading position, whereby the screed box is located directly over the form;

delivering the composite to a leveling hopper contained within the screed box; and

sliding the leveling hopper back and forth within the screed box, whereby the composite fills the form with composite.

76. The method according to claim 74, further comprising rotating an auger to evenly distribute the composite throughout the leveling hopper.

77. The method according to claim 74, further comprising conveying the screed box to a retracted position.

78. The method according to claim 70, wherein the removing the unitary concrete block from the form comprises:

locking a bottom tube assembly of the form;
uncoupling a wall assembly and a cap from the bottom tube assembly of the form;
lifting the wall assembly and the cap from a lower level to an intermediate level, whereby the wall assembly and the cap separate from the bottom tube assembly; and
unloading the unitary concrete block.

79. The method according to claim 78, wherein unloading the unitary concrete block comprises:

rotating a swing-arm assembly to a loading position;
disassembling the wall assembly, whereby the unitary concrete block separates from the wall assembly and the cap;
loading the unitary concrete block onto the swing-arm assembly;

- lifting the wall assembly and the cap from the intermediate level to an upper level;
- rotating the swing-arm assembly to an unloading position; and
- unloading the unitary concrete block.
80. The method according to claim 79, further comprising assembling the form.
81. The method according to claim 80, wherein the step of assembling the form comprises:
- assembling the wall assembly; and
- lowering the wall assembly and cap assembly to the lower level, whereby the wall assembly and cap seats on the bottom tube assembly.